

## **Four New Species of Copepods (Crustacea) Associated with Gorgonacean Corals (Cnidaria) from Bohol Island, the Philippines**

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### **ABSTRACT**

Four new species of Copepoda associated with gorgonacean corals are described from Bohol Island, the Philippines. They are *Acanthomolgus longiunguifer*, *A. geminus*, and *Paramolgus incidentus* in the order Cyclopoida and *Humescheres boholensis* n. gen., n. sp. in the order Siphonostomatoida.

Key words: Copepoda, Cyclopoida, new species, association, Gorgonacea, the Philippines

### **INTRODUCTION**

Although the Philippines comprises a vast area of marine environments the copepods associated with marine invertebrates, including those with gorgonaceans, have not been well studied (Humes, 1990). From this region only six species of copepods have been known from four species of gorgonaceans as follows. Humes (1990) recorded *Forhania philippinensis* as new species from the gorgonaceans *Acabaria rubeola* (Wright and Studer) and *Suberogorgia reticulata* (Ellis and Solander). Humes (1993) recorded *Acanthomolgus astrictus* Humes and Stock, 1973 from *Muricella* sp.; *Paramolgus dapsilis* Humes as new species from *Suberogorgia reticulata*; *Forhania philippinensis*, *Thamnomolgus nodulus* Humes, 1990, *Asteropontius latus* Humes, 1992, and *Orecturus finitimus* (as new species) all four from *Villogorgia inticata* (Gray). In this paper four new species, three cyclopoids and one siphonostomatoid, are described as the

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associates of the gorgonaceans from Bohol Island, the Philippines.

## MATERIALS AND METHODS

All copepod material examined in this paper had been loaned from the National Museum of Natural History, Smithsonian Institution, United States. These copepods were among the Humes' collection of Copepoda kept in that museum. The sources of the copepod material mentioned in the following descriptions of species follow the Humes' collection note.

Before microscopical observation and dissection copepod materials were immersed in lactic acid for at least 10 minutes. Dissection was done using the reverse slide method. All figures were drawn with the aid of a camera lucida. In the description, body lengths were measured from the apex of cephalothorax to the distal end of caudal rami, excluding caudal setae. In the armature formula of legs 1-4, Roman numerals represent spines and Arabic numerals indicating setae.

## DESCRIPTIONS

Order Cyclopoida

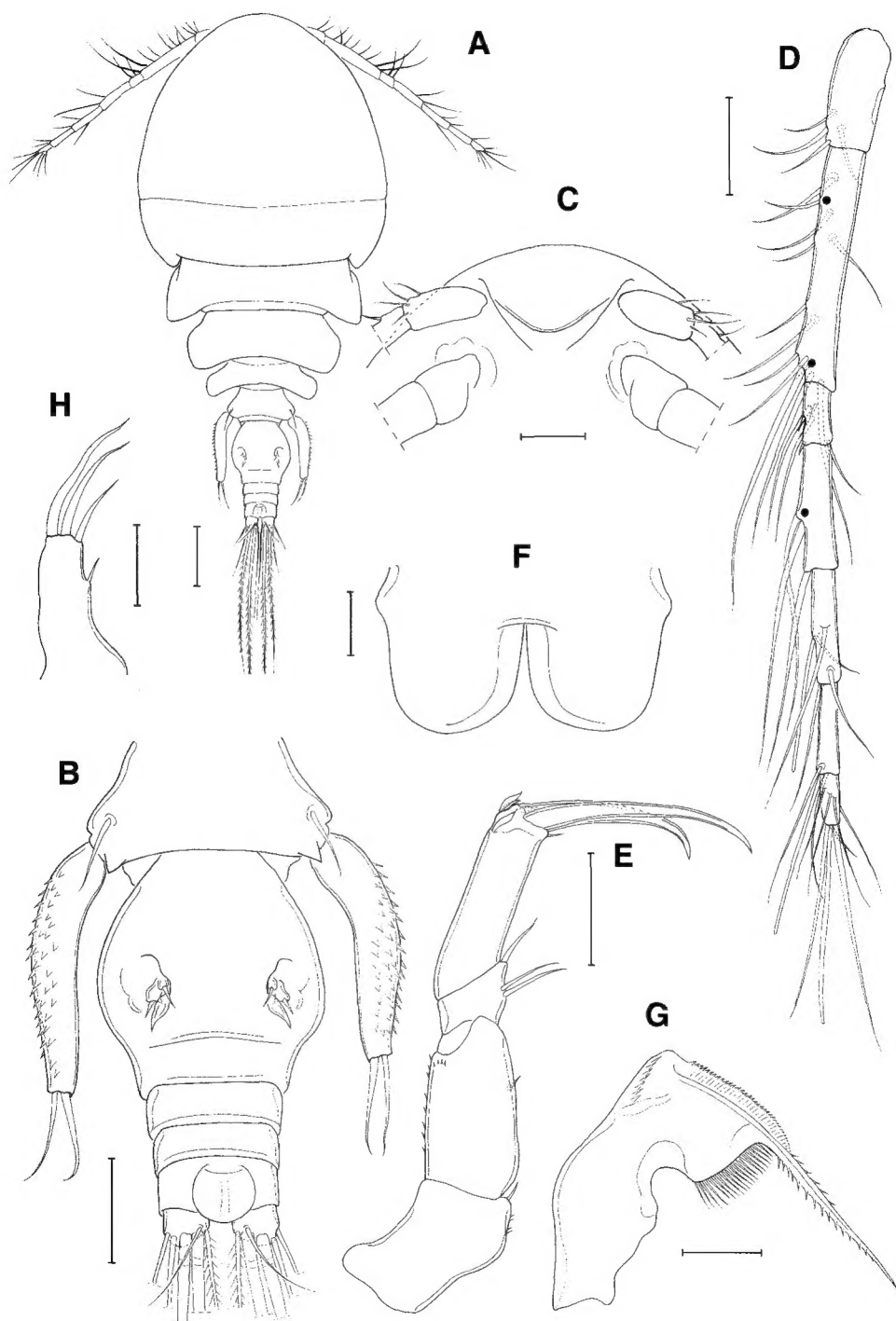
Family Rhynchomolgidae

### ***Acanthomolgus longiunguifer* n. sp. (Figs. 1-3)**

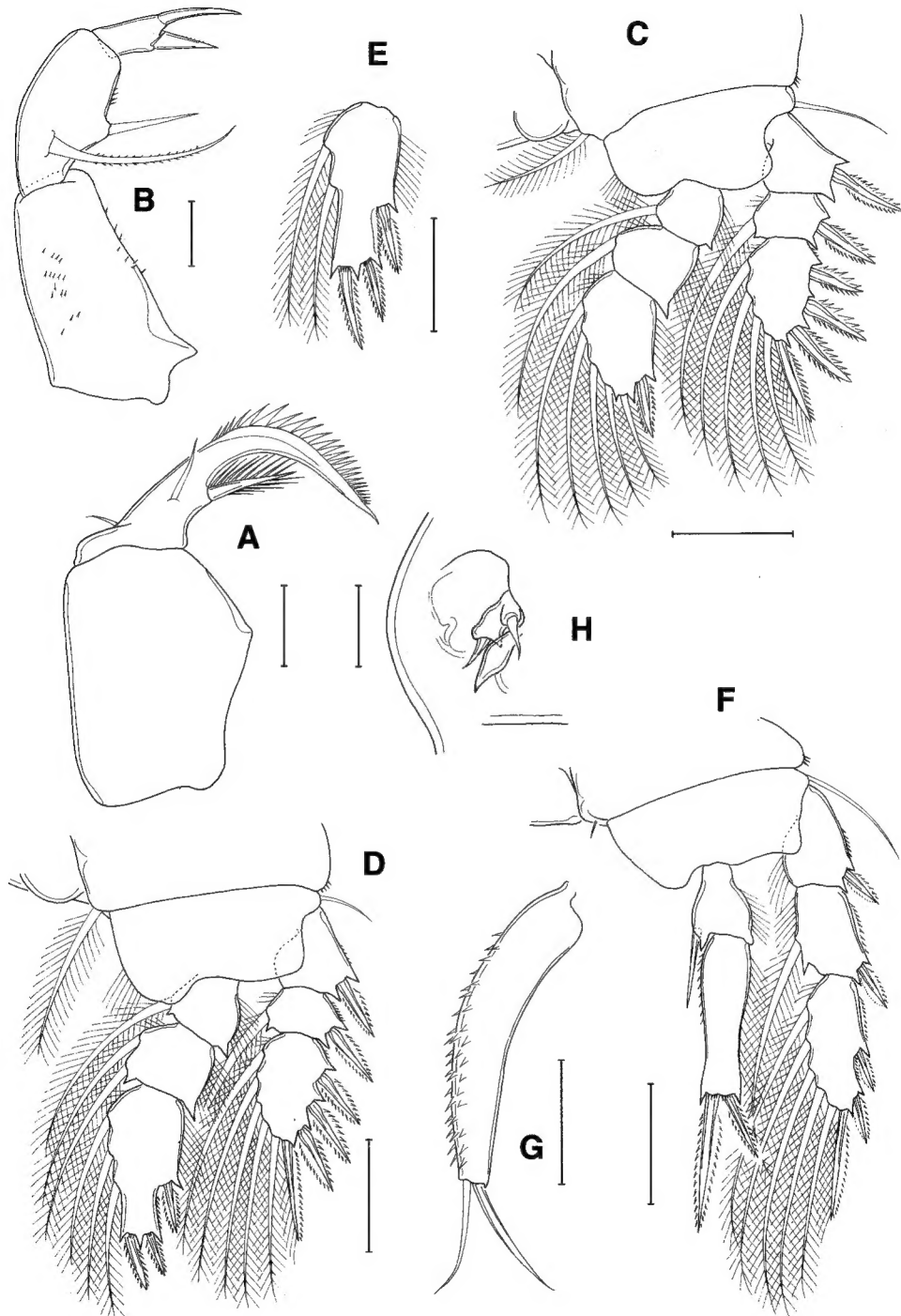
**Material examined.** 10 ♀♀, 1 ♂ from a dark lavender gorgonacean, in 30 m, Bohol Island (10° 17.9'N, 124° 10.9'E), the Philippines, 21 August 1975, collected by Thomas Forhan. Holotype (♀, USNM 1027375), allotype (♂: left maxilliped and left leg 5 dissected out, USNM 1027376), and paratypes (8 ♀♀, USNM 1027377) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratype (1 ♀) is retained in the collection of the author.

**Female.** Body (Fig. 1A) moderately narrow. Length of dissected specimen 863 µm (670-945 µm, with mean 792 µm, based on 9 specimens). Maximum width 425 µm. Prosome 637 µm long. Cephalothorax almost circular, with faint dorsal suture line delimiting cephalosome and first pedigerous somite. Epimera of second pedigerous somite tapering posterolaterally. Urosome (Fig. 1B) 5-segmented. Fifth pedigerous somite 117 µm wide, slightly wider than genital double-somite, dorsally with pointed process at posterolateral corners. Genital double-somite 111 × 110 µm; lateral margins roundly convex; genital areas located dorsally. Abdominal somites short, each 20 × 65, 14 × 60, and 28 × 58 µm from anterior to posterior. Caudal ramus small, 18 × 22 µm (0.82 : 1), with 6 caudal setae. Egg sac not seen.

Rostrum (Fig. 1C) broad. Antennule (Fig. 1D) 409 µm long, slender, 7-segmented, with armature formula of 4, 13, 6, 3, 4+1 aesthetasc, 2+1 aesthetasc, and 7+1 aesthetasc; all setae naked. Antenna (Fig. 1E) 4-segmented, with armature formula of 1, 1, 3, and 4+2 claws. Second segment with spinules along outer margin. Fourth segment approximately 78 × 27 µm. Terminal claws longer than fourth segment, 102 (slender one) and 83 µm (thicker one), respectively. Outer distal setae on fourth segment leaf-like.



**Fig. 1.** *Acanthomolgus longiunguifer* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, rostral area, ventral; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule. Scale bars = 0.02 mm (F-H), 0.05 mm (B-E), 0.1 mm (A).



**Fig. 2.** *Acanthomolgus longiunguifer* n. sp., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, third endopodal segment of leg 3; F, leg 4; G, free segment of leg 5; H, left genital area. Scale bars = 0.02 mm (A, B, H), 0.05 mm (C-G).

Labrum as Fig. 1F. Mandible (Fig. 1G) with broad proximal notch; linear inner margin almost perpendicular to terminal lash. Convex side prominent with row of spinules. Terminal lash long and spinulated. Maxillule (Fig. 1H) with 1 small lateral setiform process and 3 smooth terminal setae. Maxilla (Fig. 2A) with unarmed first segment. Second segment with 3 setae; inner seta with long spinules on both margins; anterior and proximal setae smooth. Lash with spinules along convex margin. Maxilliped (Fig. 2B) with small spinules scattered on first segment. Second segment with 2 unequal setae, larger one 61  $\mu$ m and smaller one 29  $\mu$ m. Third segment longer than wide, slightly broadened distally and terminated by 2 unequal processes and 1 small setule.

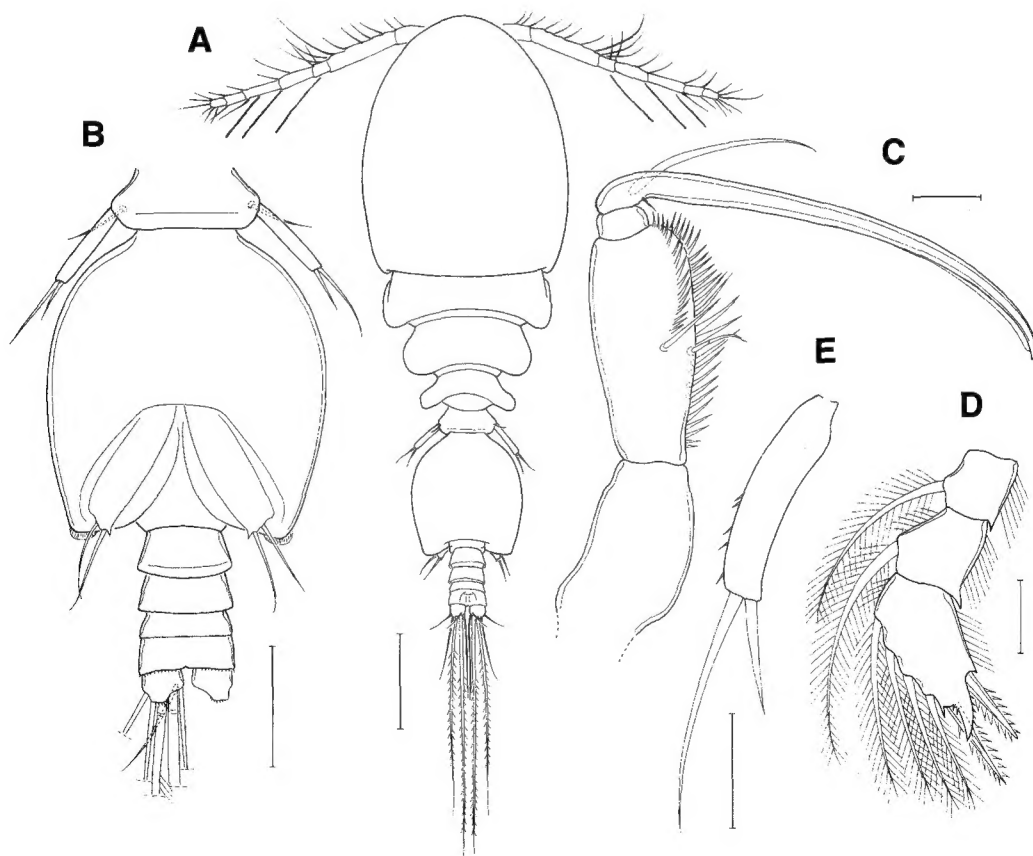
Legs 1-4 with 3-segmented rami except for 2-segmented endopod of leg 4 (Fig. 2C-F). Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,4; enp 0-1; 0-1; I,5

Leg 2: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,5; enp 0-1; 0-2; I,II,3

Leg 3: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,5; enp 0-1; 0-2; I,II,2

Leg 4: coxa 0-1; basis 1-0; exp I-0; I-1; II,I,5; enp 0-I; II



**Fig. 3.** *Acanthomolgus longiunguifer* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, maxilliped; D endopod of leg 1; E, free segment of leg 5. Scale bars = 0.02 mm (C-E), 0.05 mm (B), 0.1 mm (A).

Outer seta on coxa of legs 1-4 smooth. Leg 4 with minute inner coxal seta; inner spine on first endopodal segment 33  $\mu\text{m}$  long, barely extending to middle of second segment; second segment  $67 \times 21 \mu\text{m}$ , with small spinules along inner margin, its 2 terminal spines 59  $\mu\text{m}$  (inner) and 28  $\mu\text{m}$  (outer).

Free segment of leg 5 (Fig. 2G)  $125 \times 25 \mu\text{m}$ , ratio 5.0 : 1, evenly curved, with straight lateral margins; two terminal setae large and smooth, 97  $\mu\text{m}$  (inner) and 79  $\mu\text{m}$  (outer). Leg 6 represented by 1 setule and 1 small spinule in genital area (Fig. 2H).

**Male.** Body (Fig. 3A) 628  $\mu\text{m}$  long, more slender than that of female. First pedigerous somite completely fused with cephalosome to form cephalothorax. Cephalothorax  $272 \times 214 \mu\text{m}$ . Urosome (Fig. 3B) 6-segmented. Fifth pedigerous somite 62  $\mu\text{m}$  wide. Genital somite  $124 \times 116 \mu\text{m}$ , with narrow membrane along both sides of posterior margin. Four abdominal somites  $18 \times 40$ ,  $15 \times 39$ ,  $11 \times 38$ , and  $15 \times 40 \mu\text{m}$ , respectively. Caudal ramus slightly wider than long,  $15 \times 17 \mu\text{m}$ .

Rostrum as in female. Antennule added by 3 aesthetascs, 2 on second and 1 on fourth segments (at dots in Fig. 1D). Antenna, labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 3C) with unarmed first segment. Second segment gradually broadened distally, with 2 similar setae near middle of inner side, 1 row of spinules along whole inner margin and another row of spinules along distal half of inner margin. Short third segment unarmed. Terminal segment forming slender claw, proximally with 1 long seta and 1 small setule.

Endopod of leg 1 (Fig. 3D) with 2 spines and 4 setae (formula II,4) and terminally scalpel-shaped process armed with spinules along outer margin. Legs 2-4 as in female. Free segment of leg 5 (Fig. 3E) narrow, weakly curved,  $38 \times 8.7 \mu\text{m}$  (ratio 4.37 : 1), with several spinules on distal half of outer margin; outer one of 2 terminal setae about twice as long as inner one, both smooth. Leg 6 represented by 2 similar setae on posterior part of genital flap.

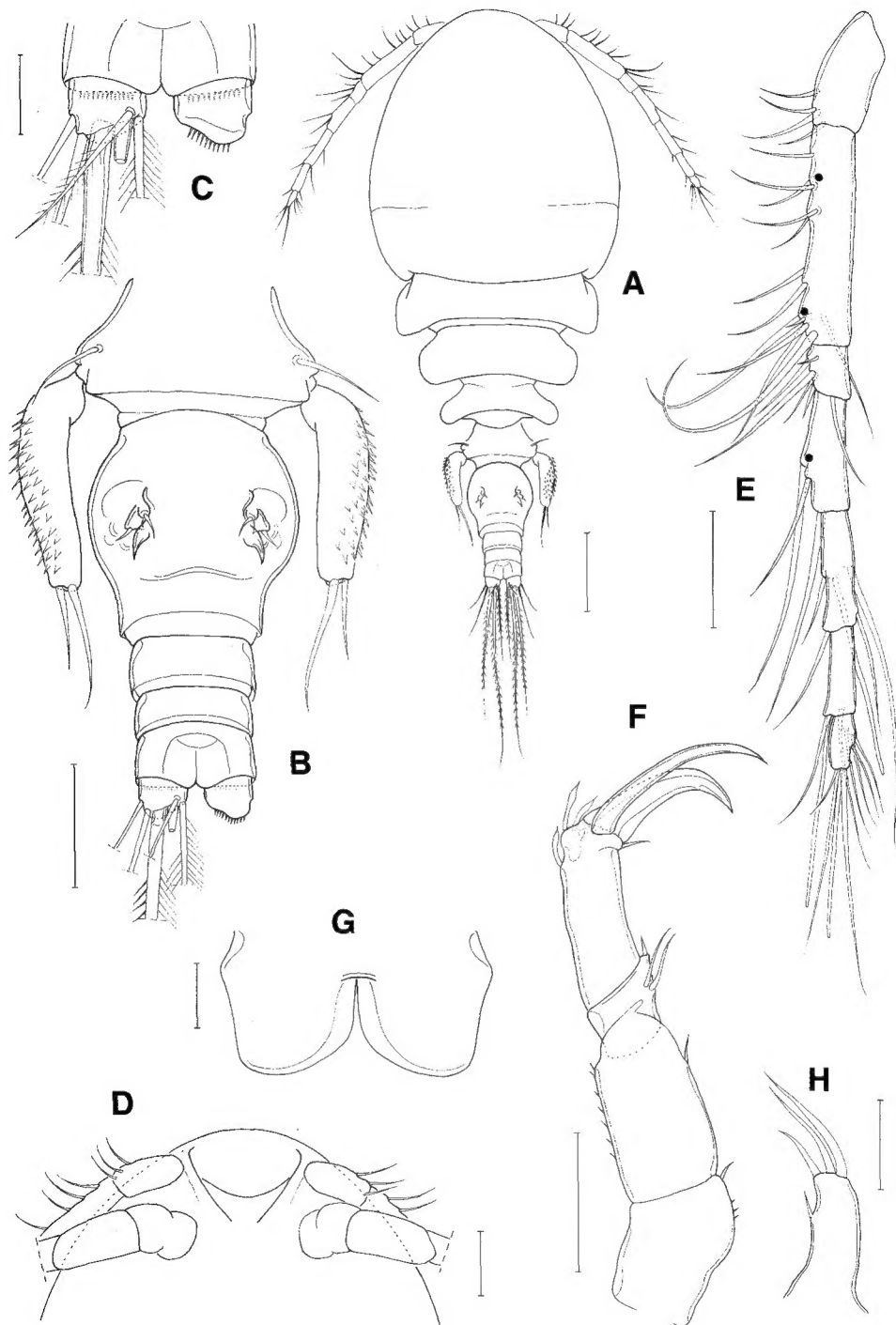
**Remarks.** Four species of *Acanthomolgus* have, as *A. longiunguifer*, a combination of characters that the caudal ramus is as long as or shorter than wide and the proximal inner swelling of the free segment of female leg 5 is weak or absent: *A. astrictus* Humes and Stock, 1973; *A. bilobipes* Humes and Stock, 1973; *A. bohollensis* Humes, 1990; and *A. variostratus* (Humes and Ho, 1968). The former two species were found from the gorgonaceans, and the latter two from the alcyonaceans. These four species differ from *A. longiunguifer* in having the following characters which are not applicable to *A. longiunguifer*.

**Etymology.** The specific name *longiunguifer* is the combination of the Latin *longus* (= long) + *unguis* (= claw) + *fero* (= to bear), alluding to the long terminal claws of the antenna.

In *Acanthomolgus astrictus* known from Madagascar, the free segment of female leg 5 bears a beak-like proximal process, the inner margin of mandible is convex (see Fig. 50d of Humes and Stock, 1973), the two terminal claws on antenna are distinctly differ in thickness (shorter spine is about twice as thick as longer one), and the antennular setae is distinctly longer.

*Acanthomolgus bilobipes* known from Puerto Rico has the antenna in which the terminal claws distinctly shorter than fourth segment, three setae on maxillule, the bilobed inner margin on the free segment of female leg 5.

In *Acanthomolgus bohollensis* known from the Philippines, two terminal claws of antenna are very unequal in thickness, the free segment of leg 5 is shorter, only 83  $\mu\text{m}$  long and tapering in the



**Fig. 4.** *Acanthomolgus geminus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, caudal rami, dorsal; D, rostral area, ventral; E, antennule; F, antenna; G, labrum; H, maxillule. Scale bars = 0.02 mm (C, F-H), 0.05 mm (B, D-F), 0.1 mm (A).

female, and 25  $\mu\text{m}$  long and straight in the male.

In *Acanthomolgus variostratus* known from Madagascar, the maxillule is armed with only three setae, two inner setae on the second segment of female maxilliped are extremely unequal in length (longer seta is about four times as long as shorter one, according to figure of Humes and Ho, 1968), the free segment of female leg 4 is tapering and that of the male carries one spine and one seta.

### ***Acanthomolgus geminus* n. sp. (Figs. 4-6)**

**Material examined.** 153 ♀♀, 133 ♂♂ from a gorgonacean (stout orange stalks), in 30 m, Bohol Island (10° 17.9'N, 124° 10.9'E), the Philippines, 21 August 1975, collected by T. Forhan. Holotype (♀, USNM 1027378), allotype (♂, USNM 1027379), and paratypes (151 ♀♀, 131 ♂♂, USNM 1027380) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1 ♀, 1 ♂) are retained in the collection of the author.

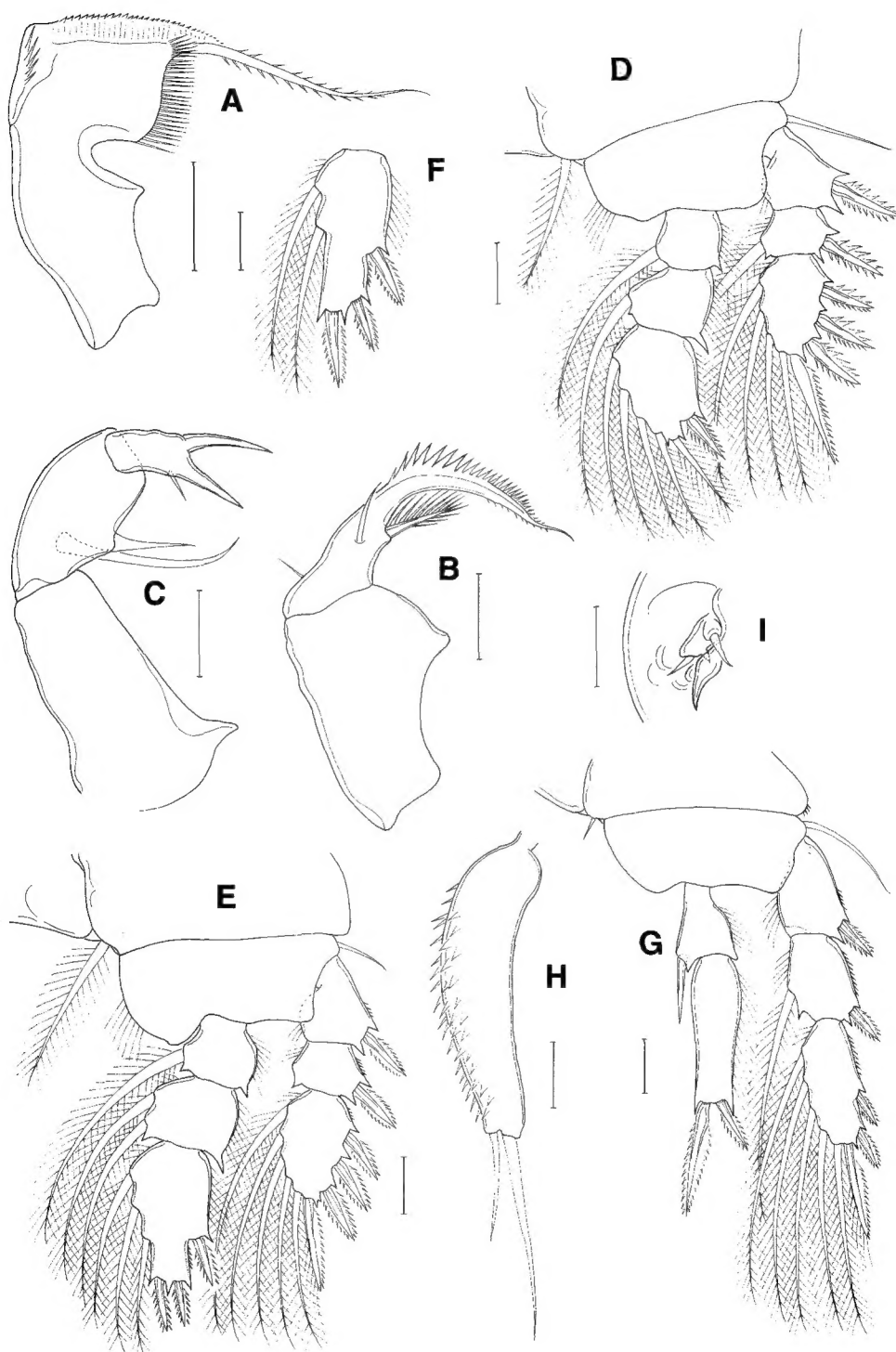
**Female.** Body (Fig. 4A) 742  $\mu\text{m}$  (720-775  $\mu\text{m}$ ) based on 10 specimens. Prosome 529  $\mu\text{m}$  long. Cephalothorax 318  $\mu\text{m}$  wide, with faint, incomplete dorsal suture line between cephalosome and first pedigerous somite. Urosome (Fig. 4B) relatively small, 5-segmented. Fifth pedigerous somite 98  $\mu\text{m}$  wide, wider than genital double-somite. Genital double-somite 90 × 84  $\mu\text{m}$ , with roundly expanded lateral margins and transverse posterodorsal ridge. Genital areas located dorsally, accompanied posteriorly claw-like process (Figs. 4B, 5I). Three abdominal somites 20 × 51, 16 × 48, and 25 × 49  $\mu\text{m}$ , respectively. Posteroventral margin of anal somite rimmed with fine spinules. Caudal ramus shorter than wide, 16 × 19  $\mu\text{m}$  (ratio 0.84 : 1), with 6 setae and fine spinules on posterior margin (Fig. 4C).

Rostrum directed ventrally (Fig. 4D). Antennule (Fig. 4E) 7-segmented, slender, 325  $\mu\text{m}$ , with armature formula: 4, 13, 6, 3, 4+1 aesthetasc, 2+1 aesthetasc, and 4+1 aesthetasc; all setae naked. Antenna (Fig. 4F) 4-segmented, rather stocky. First segment with 1 small inner distal seta. Second segment longer than first, with 1 inner seta and several small spinules along outer margin. Short third segment with 2 longer setae and 1 small distal seta. Fourth segment 58 × 24  $\mu\text{m}$ , with 5 setae, and terminally 1 slender (72  $\mu\text{m}$  long) and 1 shorter (56  $\mu\text{m}$ ), thick spines; 5 outer distal setae distally expanded, scalpel-like.

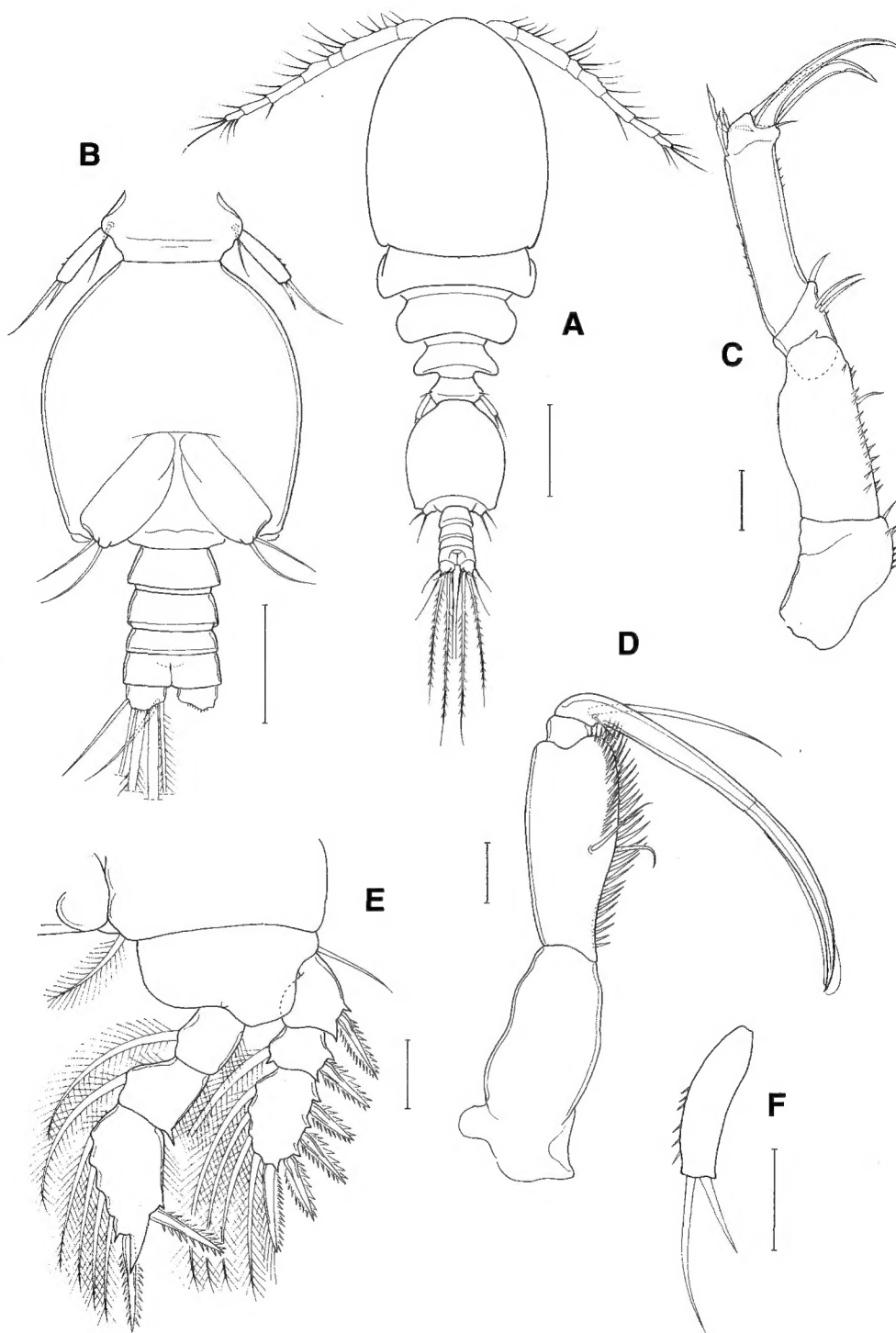
Labrum as Fig. 4G and unarmed. Mandible (Fig. 5A) with distinct proximal notch; inner margin perpendicular to terminal lash, armed with long, slender spinules; convex side with 5 spinules; terminal lash slender and long, armed with spinules along both margins. Maxillule (Fig. 4H) armed with 1 subdistal setiform process and 3 naked terminal setae. Maxilla (Fig. 5B) with unarmed first segment; second segment with 3 setae, inner one armed with spinules along whole distal margin and 3 smaller spinules on proximal margin; terminal lash moderately broad, with distinctly serrate outer (distal) margin. Maxilliped (Fig. 5C) 3-segmented; first segment longest but unarmed; second segment with 2 inner naked setae, each 47 and 19  $\mu\text{m}$ ; third segment longer than wide, armed with 1 small subdistal seta and 1 large spine and terminated by spiniform process.

Legs 1-3 biramous, with 3-segmented rami. Outer seta on coxa of legs 1-4 naked (Fig. 5D, E, G). Leg 4 (Fig. 5G) with 3-segmented exopod and 2-segmented endopod; inner spine of first endopodal segment 25  $\mu\text{m}$  long; second endopodal segment 55 × 19  $\mu\text{m}$ ; 2 terminal spines 43 and





**Fig. 5.** *Acanthomolgus geminus* n. sp., female. A, mandible; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, third endopodal segment of leg 3; G, leg 4; H, free segment of leg 5; I, left genital area. Scale bars = 0.02 mm.



**Fig. 6.** *Acanthomolgus geminus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antenna; D maxilliped; E, leg 1; F, free segment of leg 5. Scale bars = 0.02 mm (C-F), 0.05 mm (B), 0.1 mm (A).

20  $\mu\text{m}$ . Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,4; enp 0-1; 0-1; I,5

Leg 2: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,5; enp 0-1; 0-2; I,II,3

Leg 3: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,5; enp 0-1; 0-2; I,II,2

Leg 4: coxa 0-1; basis 1-0; exp I-0; I-1; II,I,5; enp 0-I; II

Free segment of leg 5 (Fig. 5H) slightly curved, gradually narrowed distally,  $92 \times 22 \mu\text{m}$  (ratio 4.18 : 1), with distinct acute scales on outer side, but without proximal swelling; 2 terminal setae naked, each 62 and 32  $\mu\text{m}$ . Leg 6 represented by 2 spiniform setae in genital area (Fig. 5I).

Male. Body (Fig. 6A) distinctly more slender than that of female. Body length 610  $\mu\text{m}$  (550-640  $\mu\text{m}$ , mean 588  $\mu\text{m}$ , based on 10 specimens). Cephalothorax  $264 \times 200 \mu\text{m}$ , without suture line delimiting first pedigerous somite. Urosome (Fig. 6B) 6-segmented. Fifth pedigerous somite 60  $\mu\text{m}$  wide. Genital somite  $121 \times 110 \mu\text{m}$ , lateral margins rounded. Four abdominal somites short,  $19 \times 40$ ,  $16 \times 39$ ,  $10 \times 39$ , and  $14 \times 41 \mu\text{m}$ , respectively. Caudal ramus  $11 \times 17 \mu\text{m}$ .

Rostrum as in female. Antennule added by 3 aesthetascs, 2 on second and 1 on fourth segments (indicated by dots in Fig. 4E). Antenna (Fig. 6C) added by spinules on segments.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 6D) 4-segmented; first segment as long as second segment, unarmed; second segment armed as in preceding species; small third segment unarmed; fourth segment forming slender claw, proximally with 1 long naked seta and 1 small setule.

Leg 1 (Fig. 6E) different from that of female in having 2 spines and 4 setae on third endopodal segment. Legs 2-4 as in female. Free segment of leg 5 small, weakly curved,  $31 \times 9 \mu\text{m}$ , with several small spinules on outer margin and 2 naked terminal setae (each 31 and 17  $\mu\text{m}$ ). Leg 6 represented by 2 subequal setae on posterior part of genital flap.

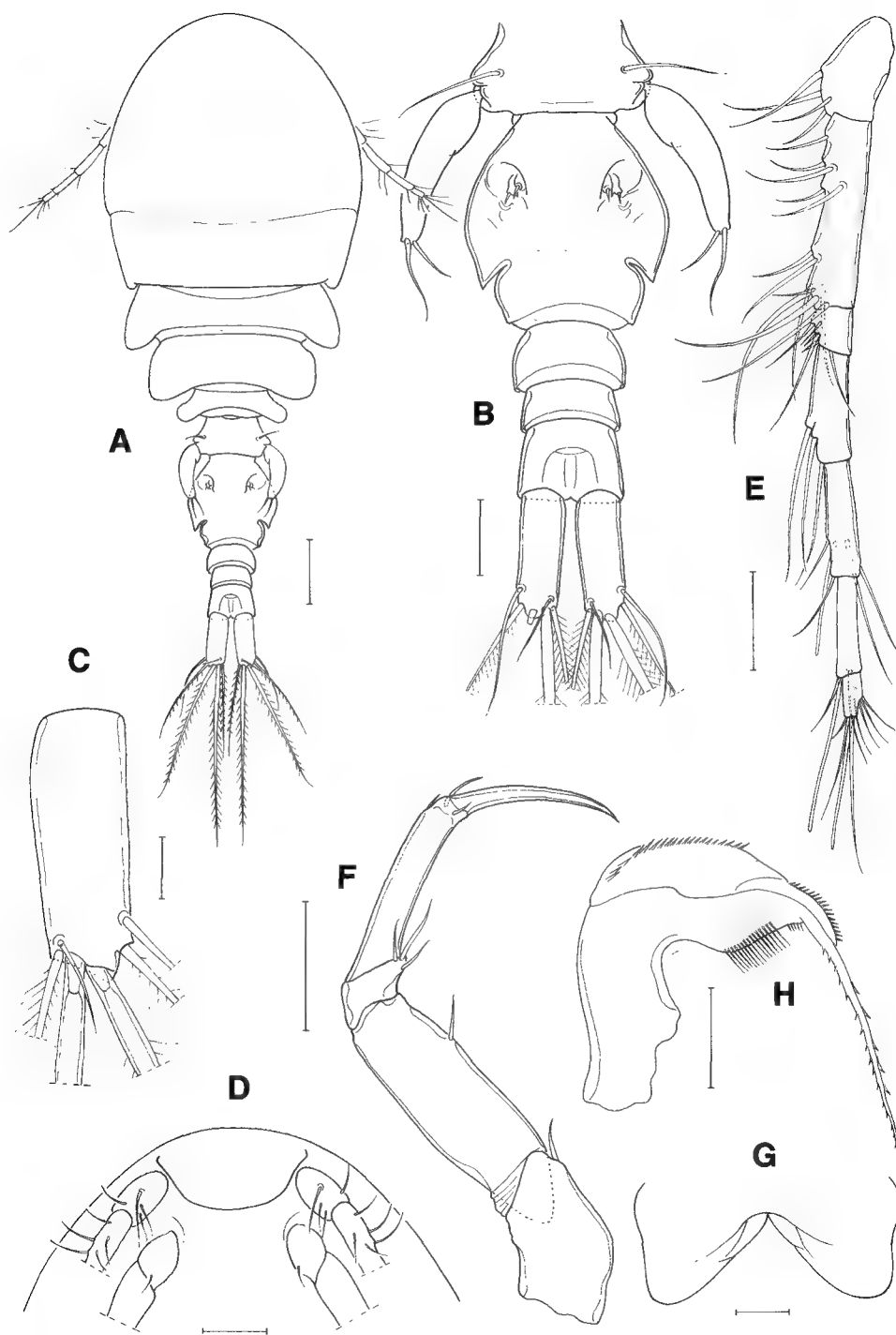
**Etymology.** The specific name *geminus* is the Latin meaning "similar". It alludes to the close resemblance of this species with *A. longiunguifer*.

**Remarks.** The new species resembles closely the preceding species *A. longiunguifer* in almost all important points. However, a careful observation results in the conclusion that they are different species and are distinguished by the following features of the new species: (1) the two terminal setae on the antenna are distinctly different in thickness, one of them being about twice as thick as the other; (2) the distal seta on the third antennal segment is distinctly smaller than the other two proximal setae on the same segment; (3) no spinules present on the inner margin of second endopodal segment of leg 4; (4) the free segment of leg 5 is shorter, with the ratio of length to width being 4.18 : 1 in the female (compared to 5.0 : 1 in *A. longiunguifer*).

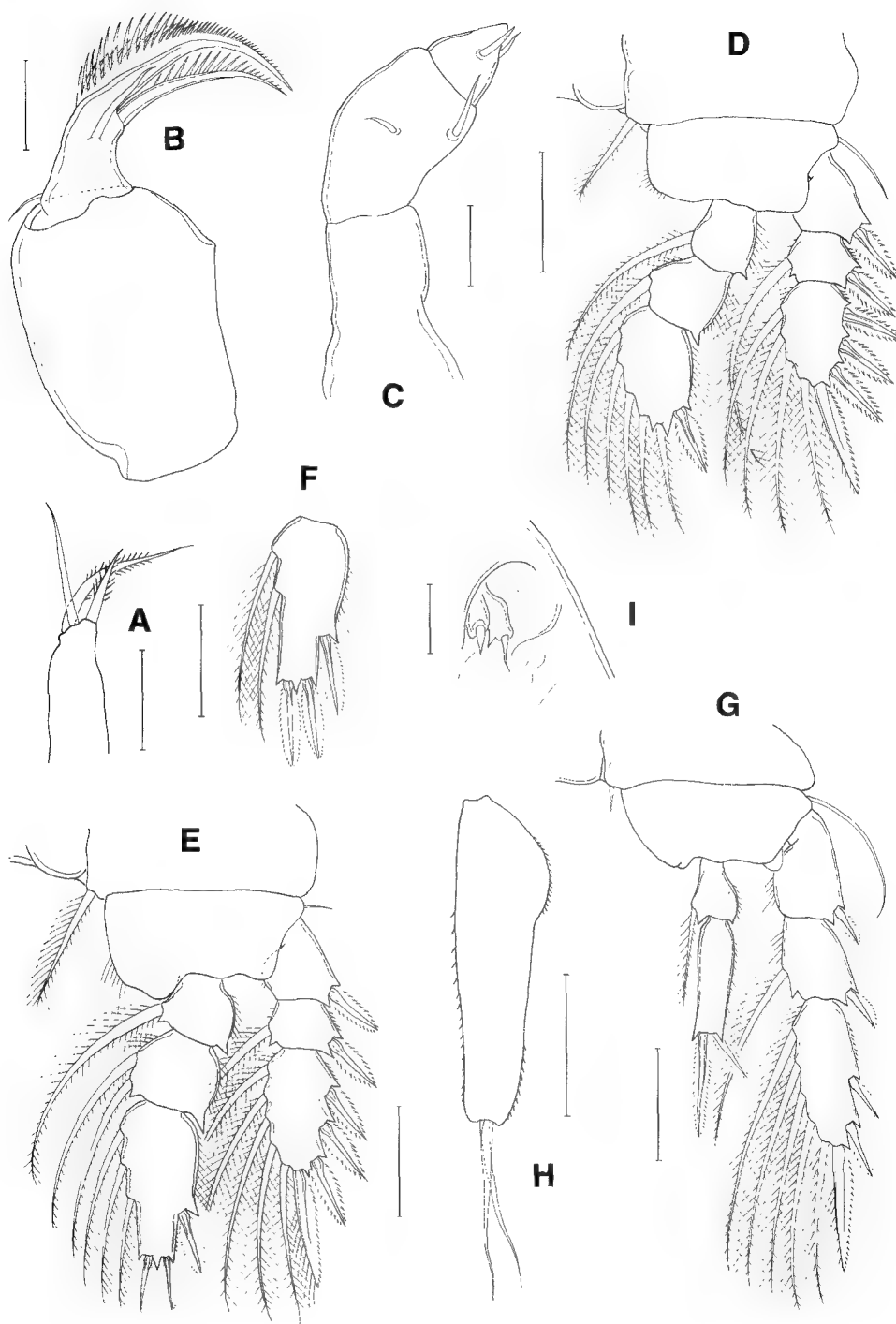
### ***Paramolgus incidentus* n. sp. (Figs. 7, 8)**

**Material examined.** 2 ♀♀ from a gorgonacean (stout orange stalks), in 30 m, Bohol Island ( $10^{\circ} 17.9'N$ ,  $124^{\circ} 10.9'E$ ), the Philippines, 21 August 1975, collected by T. Forhan. Holotype (♀, USNM 1027381) has been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratype (1 ♀) is retained in the collection of the author.

**Female.** Body (Fig. 7A) moderately broad. Body length 1.02 mm. Another specimen (holotype) 0.98 mm. Maximum width 404  $\mu\text{m}$ . Prosome 629  $\mu\text{m}$  long. First pedigerous somite distinct from cephalosome. Urosome (Fig. 7B) 122  $\mu\text{m}$  wide. Fifth pedigerous somite 122  $\mu\text{m}$  wide. Genital



**Fig. 7.** *Paramolgus incidentus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus dorsal; D, rostral area, ventral; E, antennule; F, antenna; G, labrum; H, mandible. Scale bars = 0.02 mm (C, G H), 0.05 mm (B, D-F), 0.1 mm (A).



**Fig. 8.** *Paramolgus incidentus* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, third endopodal segment of leg 3; G, leg 4; H, free segment of leg 5; I, right genital area. Scale bars = 0.02 mm (A-C, I), 0.05 mm (D-H).

double-somite  $140 \times 135 \mu\text{m}$ , characteristically with deep, narrow notch on both sides near posterior one-third of lateral margins; genital area located dorsally near anterior one-third. Three abdominal somites unornamented,  $42 \times 75$ ,  $27 \times 67$ , and  $45 \times 70 \mu\text{m}$ , respectively. Caudal ramus (Fig. 7C)  $87 \times 32 \mu\text{m}$  (ratio 2.72 : 1), both lateral margins smooth, with 6 caudal setae.

Rostrum broad (Fig. 7D). Antennule (Fig. 7E) 7-segmented, slender,  $352 \mu\text{m}$  long, with armature formula: 4, 13, 6, 3, 4+1 aesthetasc, 2+1 aesthetasc, and 7+1 aesthetasc; all setae naked. Antenna (Fig. 7F) 4-segmented, with armature formula 1, 1, 3, and 3+1 claw; second segment longest; fourth segment approximately  $70 \times 16 \mu\text{m}$ , its 3 distal setae small; terminal claw acute, slender,  $63 \mu\text{m}$  long.

Labrum (Fig. 7G) unornamented, with broad median notch. Mandible (Fig. 7H) with broad proximal notch; inner margin oblique to terminal lash, with long, thin spinules; convex margin rounded, not distinctly projected, with more than 15 small spinules; terminal lash very thin and long, with spinules along both margins. Maxillule (Fig. 8A) armed with 3 apical setae, 2 of them spiniferous. Maxilla (Fig. 8B) with unarmed first segment. Second segment with 3 setae; inner seta large, nearly extending to tip of terminal lash, armed with spinules along outer (distal) margin. Terminal lash armed on convex outer margin with 2 rows of spinules. Maxilliped (Fig. 8C) 3-segmented; first segment unarmed and narrow; second segment with 2 unequal, naked setae, larger one about twice as long as shorter one; third segment triangular, with 2 setae and blunt terminal process.

Legs 1-4 with 3-segmented rami, except for 2-segmented endopod of leg 4. Outer seta on basis of these legs naked (Fig. 8D, E, G), that of leg 2 distinctly smaller than those of other legs. Leg 4 (Fig. 8G) with small inner seta on coxa; inner seta on first endopodal segment distinctly shorter than second endopodal segment; second endopodal segment  $51 \times 16 \mu\text{m}$ , both lateral margins nearly parallel; 2 terminal spines 47 and  $24 \mu\text{m}$  respectively. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,4; enp 0-1; 0-1; I,5

Leg 2: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,5; enp 0-1; 0-2; I,II,3

Leg 3: coxa 0-1; basis 1-0; exp I-0; I-1; III,I,5; enp 0-1; 0-2; I,II,2

Leg 4: coxa 0-1; basis 1-0; exp I-0; I-1; II,I,5; enp 0-1; II

Free segment of leg 5 (Fig. 8H)  $115 \times 33 \mu\text{m}$  (ratio 3.48 : 1), narrowed distally, proximally roundly expanded on inner margin, with fine spinules on outer margin and distal and proximal part of inner margin; two terminal setae 64 and  $60 \mu\text{m}$  respectively, naked, and similar in length and thickness. Leg 6 represented by 2 small setae in genital area (Fig. 8I).

**Male.** Unknown.

**Etymology.** The specific name *incidentus* is derived from the Latin *incido* meaning "to cut into". It alludes to the lateral notches on the genital double-somite.

**Remarks.** This species possesses, as a distinctive character, a pair of deep notch on lateral margins of genital double-somite. This feature is shared with four congeners: *P. constrictus* Humes, 1969; *P. delicatulus* Humes, 1992; *P. inconstans* Humes and Dojiri, 1979; and *P. insectus* Humes, 1969. The new species may be distinguished from those congeners by the following features different from those of the new species (features of the new species are indicated in parenthesis).

In *Paramolgus constrictus* known as associate of an antipatharian in Madagascar, the caudal ramus is 64  $\mu\text{m}$  (87  $\mu\text{m}$ ) and 1.88 times (2.72 times) as long as wide; the antenna is stocky (slender); the two terminal setae on the free segment of female leg 5 is unequal (nearly equal), one of them spiniform (both are setae); and the terminal lash of maxilla is short (long).

In *Paramolgus delicatulus* known from an antipatharian in the Philippines, the lateral margins of cephalothorax are nearly parallel (round); the caudal ramus is short and 1.36 times as long as wide; the outer seta on the basis of legs 1, 3 and 4 is very small (not small); the antenna is stocky (slender); and the inner setae on the second segment of maxilla thin and naked (moderately thick and spiniferous).

In *Paramolgus inconstans* recorded from an alcyonacean in the Moluccas, the body is large, 2.13–2.32 mm according to Humes & Dojiri, 1979 (only 1.02 mm); the caudal ramus is tapering, slender, and 4.49 times as long as wide; three terminal setae of maxillule is leaf-like (slender); and the female maxilliped bears a large, blunt lobe on the terminal segment (absent).

In *Paramolgus insectus* recorded from an antipatharians in Madagascar, with which the new species is most closely allied in most respects including the similar genital double-somite, the free segment of female leg 5 is  $152 \times 42 \mu\text{m}$  (Humes, 1969), thus distinctly longer than that of *P. incidentus* ( $115 \times 33 \mu\text{m}$ ), with its proximal expansion more distinct; the two terminal setae on the free segment of female leg 5 is unequal (nearly equal), one of them spiniform (both are setae); the mandible carries a scale on the convex side (only a row of spinules); and the body length is 1.28–1.47 mm (Humes, 1969), thus distinctly larger than *P. incidentus*.

#### Order Siphonostomatoida

#### Family Asterocheridae

#### **Humescheres** n. gen.

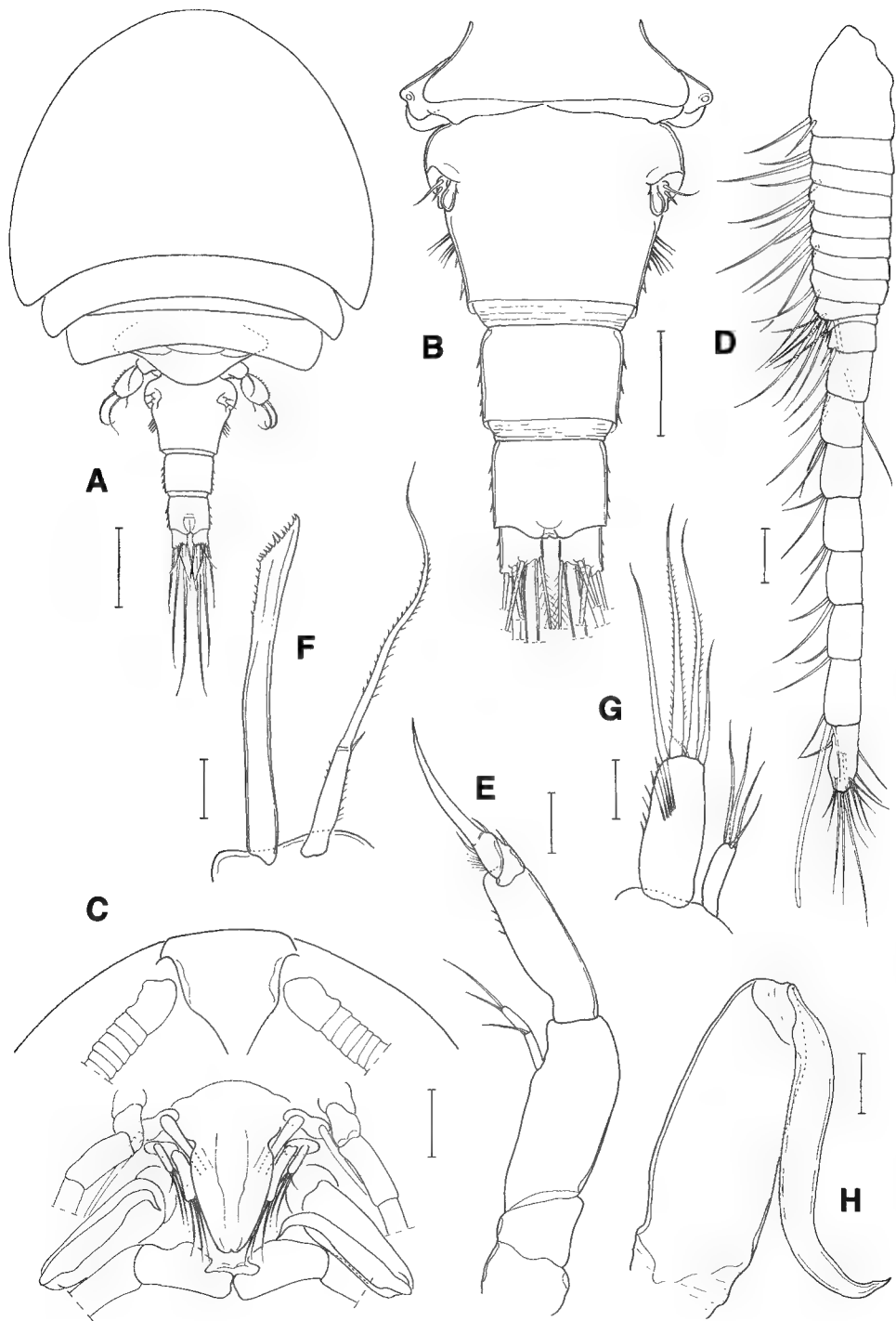
**Diagnosis.** Asterocheridae. Exoskeleton weak. Prosome expanded. Urosome 4-segmented in female and 5-segmented in male. Antennule 19-segmented in female and 17-segmented in male. Antennary exopod 2-segmented, with 1 seta on first and 2 setae on second segment. Mandible slightly expanded distally with oblique cutting edge. Palp 1-segmented, terminally with 1 large and 1 small setae. Legs 1–4 with 3-segmented rami. Third exopodal segment of legs 1–4 with armature formula III,4; III,1,4; III,1,4; and II,II,4, respectively. Third endopodal segment of legs 1–4 with armature formula 1,5; 1,5; 1,5; and 1,1,2, respectively.

**Type species.** *Humescheres boholensis* n. sp.

**Etymology.** Named after the late Dr. A. G. Humes and from “-cheres”, the ending of many generic names in the Asterocheridae.

**Remarks.** Boxshall and Halsey (2004) recognized 55 genera as valid in the family Asterocheridae. Three of these are known to have 2-segmented exopod of antenna as the new genus: *Australomyzon* Nicholls, 1994, *Cletopontius* Thompson and Scott, 1903, and *Indomyzon* Ummerkuty, 1966.

*Humescheres* is clearly defined from these genera by the different leg setation: from *Australomyzon* which has four spines and five setae (III,1,5) on the third exopodal segment of legs 2–4 (III,1,4 in *Humescheres*); from *Cletopontius* which has a reduced setation on legs 3 and 4, and no endopod of leg 4; from *Indomyzon* which has a reduced setation on legs 1–4, for example,



**Fig. 9.** *Humescheres boholensis* n. gen. n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, cephalic area, ventral; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla. Scale bars = 0.02 mm (C-H), 0.05 mm (B), 0.1 mm (A).



only four spine and three setae (III,I,3) on the third exopodal segment (III,I,4 in *Humescheres*), and only a single inner seta on the second endopodal segment (two setae in *Humescheres*) of leg 1.

***Humescheres boholensis* n. sp. (Figs. 9–11)**

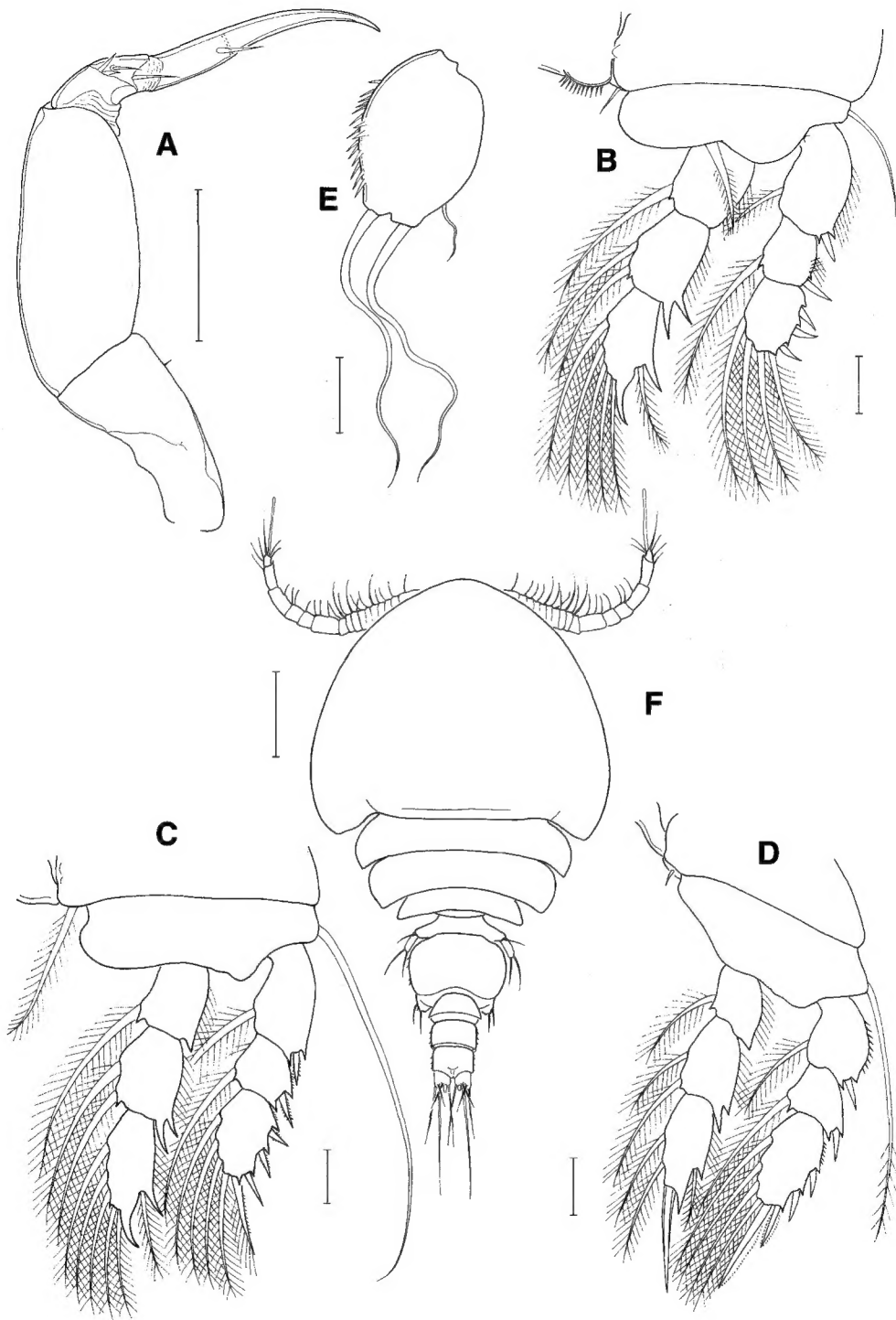
**Material examined.** 6♀, 7♂ from a gorgonacean (stout orange stalks), in 30 m, Bohol Island (10° 17.9'N, 124° 10.9'E), the Philippines, 21 August 1975, collected by T. Forhan. Holotype (♀, USNM 1027382), allotype (♂, USNM 1027383), and paratypes (4♀, 5♂, USNM 1027384) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are retained in the collection of the author.

**Other material examined.** 2♀ (1♀ dissected out), 1♂ from the gorgonacean *Subergorgia reticulata* (Ellis and Solander), in 30 m, Bohol Island (10° 17.9'N, 124° 10.9'E), the Philippines, 21 August 1975, collected by T. Forhan.

**Female.** Body (Fig. 9A) flat, with wide prosome and narrow urosome; exoskeleton very weak, easily flexible. Body length 683 µm, maximum width 462 µm. Prosome nearly circular, 433 µm long. Cephalothorax 310 µm long, distinctly shorter than wide, formed by complete fusion between cephalosome and first pedigerous somite. Second and third pedigerous somites short, similar in length. Fourth pedigerous somite covered by third pedigerous somite in dorsal view, distinctly narrower than and about half as wide as preceding somite, with tapering lateral margins. Urosome (Fig. 9B) 4-segmented, tapering. Fifth pedigerous somite 117 µm wide, wider than genital double-somite. Genital double-somite 105 × 124 µm, gradually narrowed distally, with several setules and scales along lateral margins posterior to genital area; genital area located dorsolaterally at one-third length of somite, with lobate process (Fig. 9B). Two abdominal somites 56 × 69 and 46 × 55 µm respectively, each ornamented with 3 or 4 scales on lateral margins. Caudal ramus 26 × 21 µm (ratio 1.24 : 1), with short inner margin, longer outer margin, 2 scales on outer margin, and 6 caudal setae.

Rostrum tapering posteriorly, its posterior portion diminishing and fused with ventral surface (Fig. 9C). Antennule 190 µm long, 19-segmented, 10th segment indistinct, with armature formula: 2, 2, 2, 2, 2 (fifth), 2, 2, 2, 7, 2 (10th), 2, 2, 2, 2, 2 (15th), 2, 2, 2 + 1 aesthetasc, and 13; first to 9th segment distinctly broader than remaining segments; all setae naked and relatively small. Antenna (Fig. 9E) consisting of precoxa, coxa, basis, 2-segmented exopod, and 3-segmented endopod. Precoxa, coxa, and basis unarmed. Basis about 62 µm long. Exopod small; first segment 12 × 3 µm, with 1 small distal seta; second segment identical in size to first segment, 12 × 3 µm, with 2 terminal unequal setae. First endopodal segment 54 µm long, with few spinules on outer margin; short second and third endopodal segments each with 1 small distal seta. Terminal claw 47 µm long, naked, slightly curved, vaguely delimited from third endopodal segment.

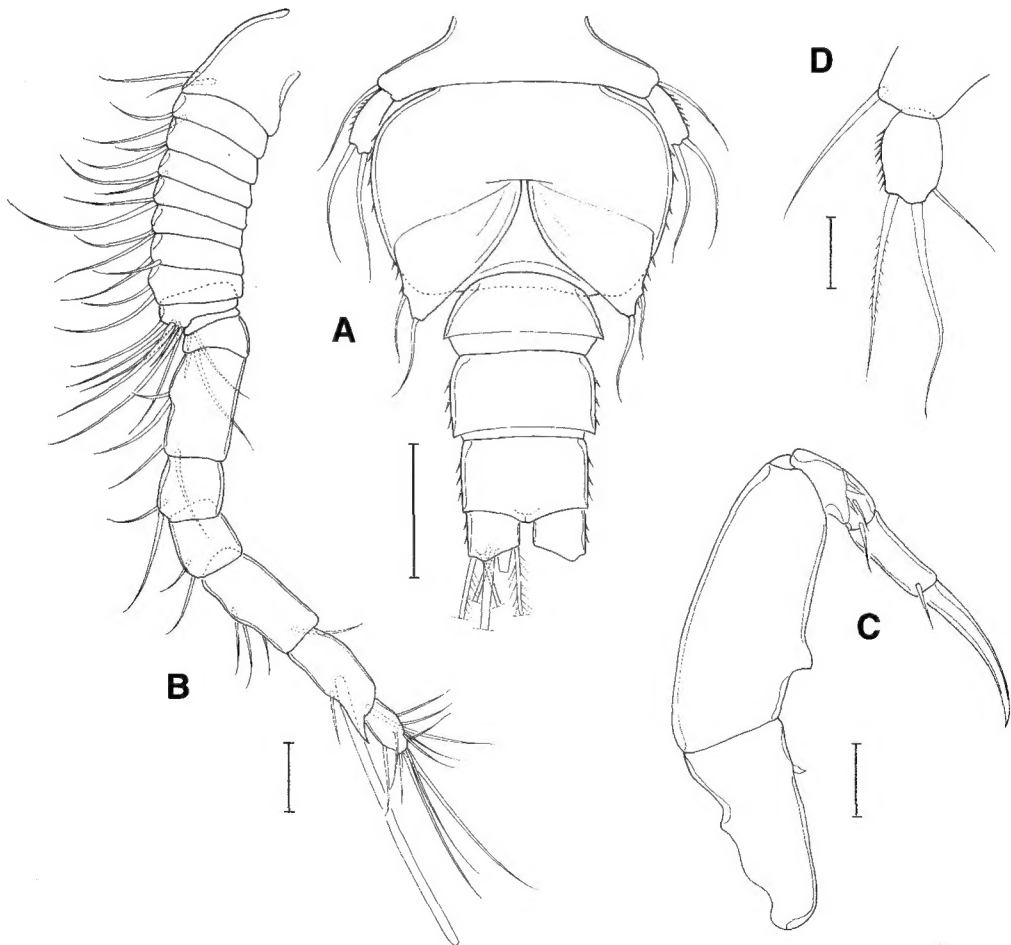
Oral cone extending near bases of maxilliped and ovoid (Fig. 9C). Mandible (Fig. 9F) 117 µm long, slightly expanded distally, with oblique distal cutting edge bearing more than 10 small, acute teeth. Mandibular palp 38 µm long, terminally with 1 large seta (vague suture line between these) and 1 small seta; larger seta extended beyond end of mandible, with small setules (or spinules) on margins. Maxillule (Fig. 9G) bilobed. Outer lobe (exopod) slender, 23 µm long, with 4 terminal setae. Inner lobe (endopod) 50 µm long, broad, with spinules along inner margin, 1 row of long



**Fig. 10.** *Humescheres bohollensis* n. gen. n. sp. Female: A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, free segment of leg 5. Male: F, habitus, dorsal. Scale bars = 0.02 mm (B-E), 0.05 mm (A), 0.1 mm (F).

setules near middle, and 4 distinct and 1 minute setae terminally. Maxilla (Fig. 9H) 2-segmented, massive, and unarmed; second segment as claw curved distally. Maxilliped (Fig. 10A) consisting of 5 segments and terminal claw; first segment narrow, with minute inner seta; second segment expanded and unarmed; third to fifth segments armed respectively with 2, 2, and 1 setae. Terminal claw indistinctly delimited from last segment and acute.

Legs 1-4 biramous, with 3-segmented exopod and endopod. Intercoxal plate of leg 1 with 1 row of spinules on both sides of posterior margin (Fig. 10B). Inner coxal seta of legs 1 and 4 minute and naked, those of legs 2 and 3 large and plumose. Outer seta on basis of legs 2-4 very long, extended at least to end of third exopodal segment (Fig. 10C, D), that of leg 1 distinctly shorter. Posteromedian seta on basis of leg 1 weakly plumose, extending to posterior border of first endopodal segment. Legs 1-4 with bicuspid inner distal corner on second endopodal segment. Legs 1-3 with acute inner distal and terminal processes on third endopodal segment. Leg 3



**Fig. 11.** *Humescheres boholensis* n. gen. n. sp., male. A, urosome, ventral; B, antennule; C, maxilliped; D leg 5. Scale bars = 0.02 mm (B-D), 0.05 mm (A).

identical to leg 2. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-1; exp I-1; I-1; III,4; enp 0-1; 0-2; 1,5

Legs 2 & 3: coxa 0-1; basis 1-0; exp I-1; I-1; III,I,4; enp 0-1; 0-2; 1,5

Leg 4: coxa 0-1; basis 1-0; exp I-1; I-1; II,II,4; enp 0-1; 0-2; 1,I,2

Free segment of leg 5 (Fig. 10E) oval,  $46 \times 34 \mu\text{m}$ , with spinules on outer margin, 2 long terminal setae, and 1 small inner distal seta; 2 terminal setae identical in size,  $88 \mu\text{m}$  long, naked, and irregularly curved. Leg 6 represented by 2 small setae in genital area (Fig. 9B).

**Male.** Body (Fig. 10F)  $603 \mu\text{m}$  long, less expanded than in female. Prosomites distinctly narrowed from anterior to posterior. Cephalothorax  $282 \times 350 \mu\text{m}$ . Fourth and fifth pedigerous somites clearly visible in dorsal view. Urosome (Fig. 11A) 5-segmented. Fifth pedigerous somite short,  $106 \mu\text{m}$  wide. Genital somite  $77 \times 115 \mu\text{m}$ , gradually narrowed posteriorly, with several small scales on lateral margins. First to third abdominal somites  $29 \times 61$ ,  $33 \times 55$ , and  $32 \times 48 \mu\text{m}$ , respectively; second abdominal and anal somites with 3 scales on each lateral margin. Caudal ramus nearly as long as wide,  $21 \times 20 \mu\text{m}$ .

Rostrum as in female. Antennule (Fig. 11B) 17-segmented, with weak geniculation between 13th and 14th segments. Armature formula of antennule 2, 2, 2, 2, 2 (5th), 2, 2, 2, 7, 2 (10th), 2, 4, 2, 2, 4 (15th), 2+1 aesthetasc, and 12. Antenna, oral cone, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 11C) different from that of female in following points: first segment with thick inner seta; second segment with triangular process on proximal part of inner margin; and claw well demarcated from last segment.

Outer spine on first exopodal segment distinctly larger than that of female, extending to posterior margin of segment. Legs 2-4 resembling those of female. Free segment of leg 5 small and not expanded,  $25 \times 17 \mu\text{m}$ , longest one of its 3 setae  $63 \mu\text{m}$ . Leg 6 represented by 2 similar setae on genital flap (Fig. 11A).

**Etymology.** The specific name *boholensis* is derived from Bohol Island, the Philippines, from which the type specimens were collected.

## ACKNOWLEDGEMENTS

I am indebted to Mr. T. C. Walter, a copepodologist in the National Museum of Natural History, Smithsonian Institution, who made the author possible to study copepod material studied in the present work. This study was supported by the Korea Research Foundation (R05-2004-000-10302-0).

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RECEIVED: 10 August 2005

ACCEPTED: 23 September 2005

## 필리핀 보홀섬의 해양류 (자포동물문)에 공생하는 요각류 (갑각 강) 4신종

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## 요 약

필리핀 보홀섬에서 채집된 빨산호류에 공생하는 요각류 4신종을 기재하였다. 이들은 검물벼룩목 (Cyclopoida)에 속하는 *Acanthomolgus longiunguifer*, *A. geminus* 및 *Paramolgus incidentus*, 그리고 대롱입요각목 (Siphonostomatoida)에 속하는 *Humescheres boholensis*로서, 후자는 신속에 속한다.